CRX Card Reader

Generic Interface - Programmer's Guide

coinco

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1.0   INTRODUCTION

The CRX Programming Guide contains the hardware interface requirements, communication protocol, command sets, and Coinco's preferred operation of the BillPro and MC Series CRX card reader modules when connected to a credit card transaction processing system (CCTPS). This guide is intended for engineers, software developers and system integrators wishing to interface the Coinco CRX card reader with a credit card transaction processing system.

2.0   NUMERIC AND DATA FORMATS

Within this document the following numeric and data formats are used to represent hexadecimal numbers, binary numbers, and ASCII character bytes.

*   Hexadecimal numbers will be preceded with a "0x", i.e. 0x01, 0xff.

*   Binary numbers will be terminated with a "b", i.e. 0101b, 10b.

*   All other numbers are assumed to be decimal.

*   ASCII character bytes are identified by placing the byte value between the less than < and > greater than characters.

*   LRC indicates the calculated logical redundancy checksum byte

3.0   FEATURES

3.1   *Magnetic Swipe Card Reader*

*   Bidirectional ISO card reader
    Reads track 1 and track 2 encoded data that meets the ANSI (American Standards Institute) and ISO (International Standards Organization) standards.

*   Programmable track enable\disable

*   ASCII or RAW card data transmission.

3.2   *LCD Display*

*   2 Line x 16 character backlit display
*   Programmable display and cursor control

3.3   *Built-in Audible Buzzer*

*   Selectable duration, beeps, and tone.

3.4   *LED Indicator*

*   Selectable duration and blinks.

3.5   *RS-232 or 0V to 5V TTL Serial Interface*

*   Selectable TTL or RS-232 signal levels via CRX harness.

3.6   *Cancel Credit Button*

3.7   *Reverse Swipe Button*

Section 4: Hardware Interface Requirements

4.0   HARDWARE INTERFACE REQUIREMENTS

4.1   *Power*

• 5VDC +/- 10%; 0.15a max current draw

4.2   *Communications*

4.2.1   Serial Interface

• 9600 Baud
• 8 Data Bits
• No Parity
• 1 Stop Bit
• Full Duplex
• Transmits and Receives at RS-232 or 0 to 5 VDC TTL Signal Levels.

4.2.2   Four Wire Hardware Interface

• Ground
• Interface Module Receive
• Interface Module Transmit
• +5VDC Required External Power Source

4.2.3   Cabling

TTL *(Not available on MC-CRX versions)*
Pin 1 – Ground
Pin 2 – RX (5VDC)
Pin 3 – TX (5VDC)
Pin 4 – +5VDC

RS-232 *(Available on BillPro-CRX & MC-CRX versions)*
Pin 1 – NC
Pin 2 – RX (5VDC)
Pin 3 – TX (5VDC)
Pin 4 – NC
Pin 5 – Ground
Pin 6 – +5VDC
Pin 7 – NC
Pin 8 – NC
Pin 9 – NC

Section 5:CRX Interface Protocol

5.0   CRX INTERFACE PROTOCOL

5.1   *Magnetic Card Data*

The CRX module is capable of transmitting card data as either an ASCII text stream or as RAW data from the magnetic head.   The module will transmit card data after any card swipe independent of the operating state of the credit card transaction processing system.

5.1.1   ASCII

Normal operation mode the CRX module decodes the magnetic head data and converts the data to an ASCII text stream. During the decoding process the module checks for any data errors in the data received from the magnetic head, if any errors occurred, the start sentinel and end sentinel with checksum will be transmitted without card data for track 1 and/or track 2. Otherwise, the card data will be transmitted as a financial transaction card for up to two tracks.

Inter byte time must be less than 20 ms. Exceeding the inter byte time is assumed to be the end of transmission.

5.1.2   RAW

The CRX will enter RAW data mode on receipt of the ENTER RAW DATA MODE card reader command. The unit will stay in RAW data mode until the power is reset or the module receives the RESET interface command or EXIT RAW DATA MODE command from the card transaction module.

RAW data is transmitted to the card transaction module one byte at a time filling bit 7 through 0 of the data byte on receipt of each bit from the magnetic card reader head. No decoding or validity testing of the data is preformed.

Inter byte time must be less than 20 ms. Exceeding the inter byte time is assumed to be the end of transmission.

5.1.3   Card Data Handshake

The credit card transaction processing system will implement a handshake on the received data by sending an ACK (0x06) within 20ms of detecting the end of transmission. If the CRX module does not receive an acknowledgement within 40ms of sending the last character in the string, it will re-transmit the string. The module will make 3 attempts to transmit the card data before dropping the card data.

5.2   *Cancel Button*

The CRX module transmits the following Cancel Button code to the credit card transaction processing system anytime the module's Cancel Credit Button is pressed.   The Cancel Button data consists of three bytes of data representing the interface header byte <0xC1>, cancel command <0x51>, and LRC checksum.

Cancel Credit Button String = <0xC1><0x51><LRC>

LRC = 0xC1 xor 0x51 = 0x90

5.3   Swipe Button

The CRX module transmits the following Swipe Button code to the credit card transaction processing system anytime a valid card swipe occurs from a reverse card swipe (bottom to top of reader) when the bill acceptor is positioned in an up stack configuration.   The Swipe Button data consists of three bytes of data representing the interface header byte <0xC1>, swipe button command <0x52>, and LRC checksum. The Swipe Button data will precede the transmission of any card track data.

Swipe Button String = <0xC1><0x52><LRC>

LRC = 0xC1 xor 0x52 = 0x93

5.4   CRX Command Format

The CRX module command format consists of a header byte, up to 40 data bytes, and a checksum byte. The header, data and checksum bytes are transmitted to the CRX module as ASCII character bytes.

Each command has the following format:
<header><data><data>….<data><checksum>

Below is a description of each component of the CRX command format.

5.4.1   Header

The <header> byte identifies the CRX command type and number of data\command bytes to follow. The two most significant bits identify the command type and the lower six bits indicate the number of data bytes following the header byte and preceding the checksum byte.

- Bits 6 & 7 Identifies the command type to the CRX unit.

  - o   00b = Display Command
  - o   01b = Display Data
  - o   10b = Card Reader Command
  - o   11b = Interface Command

- Bits 0 - 5 Identifies the number of data/command bytes to be received (doesn't include the header or checksum). The module is capable of receiving a maximum of 40 data bytes.

Examples:

1.   The following header byte represents a Display Data Command with 8 bytes of data.

01001000b   Bits 7-6   Command Type   01 = Display Data
01**001000**b   Bits 5-0   Number of Data Bytes 001000 = 8 Data bytes

01001000b = 0x48

2.   The following header byte represents a Interface Command with 1 command byte.

11000001b Bits 7-6   Command Type   11 = Interface Command
11**000001**b Bits 5-0   Number of Data Bytes 00000 = 1 Data Byte

11000001b = 0xC1

5.4.2   Data

The <data> portion of the command format may contain up to 40 bytes of specific CRX commands for controlling the operation and configuration of the unit or display text for the CRX liquid crystal display.

5.4.3   Checksum

The <checksum> is a one byte LRC calculated by XORing the header byte with each data byte.

5.4.4   Command Handshake

The CRX Module implements a simple handshake of received data by acknowledging data received that passes the integrity check with an ACK (0x06). The ACK must be transmitted within 40ms of receiving the checksum and any transmission not acknowledged within the specified timeout should be re-transmitted.

Section 6: Command Set

6.0 COMMAND SET

The CRX command set consists of commands to control the various hardware functionality of the CRX module. The commands are divided into four categories: Display, Display Data, Card Reader, and Interface Commands. An in-depth description of each command category is provided below with the associated command tables identifying the command name, hex value, and description. The command hex value must be converted to the associated ASCII character for transmission to the module.

6.1 *Display Commands*

The Coinco CRX module supports the following LCD commands to control the cursor and display.

6.1.1 LCD Commands

The Card Transaction Module is responsible for all aspects of the display except initialization. Within the first second after power up or reset the CRX Module will reset the display and execute the LCD initialization sequence. The credit card transaction processing system should not send display commands or data during this time.

Each "data" portion of a display command is immediately forwarded to the display as an instruction byte.   Multiple display instructions may be contained in the display command string.

Commands	Value	Description
Clear Display	0x01	Erases display and returns cursor to home position
Blank Display	0x08	Turns Display Off (without clearing data)
Restore Display	0x0c	Turns Display On (with cursor hidden)
Scroll Display Left	0x18	Shifts display one character left (all lines)
Scroll Display Right	0x1c	Shifts display one character right (all lines)

Example: Blank Display =< 0x01>< 0x08> < LRC>
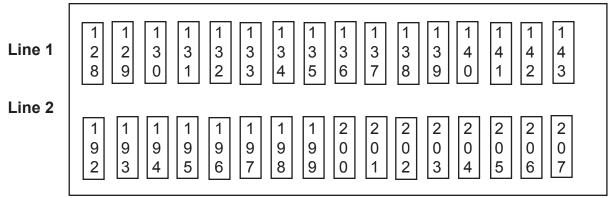
6.1.2   LCD Cursor Commands

The CRX module's cursor commands control the LCD's cursor type, visibility, and position of the cursor on the LCD.

Commands	Value	Description
Cursor Home	0x02	Returns cursor to upper left corner of display
Cursor On	0x0e	Turns on visible underline cursor
Cursor Off	0x0c	Turns off visible underline or blinking cursor
Cursor Blink	0x0d	Turns on visible blinking-block cursor
Cursor Move Left	0x10	Move cursor one character left
Cursor Move Right	0x14	Mover cursor one character right
Set Cursor Position	0x80 + address	Moves cursor to the specified address 0x80 to 0x8F and 0xCO to 0xCF
Set Cursor Position to Line 1	0x80	Sets cursor position to start of line 1
Set Cursor Postion to Line 2	0xc0	Sets cursor postition to start of line 2

Example1:   *Cursor Home =< 0x01>< 0x02> <LRC>*

The cursor can be positioned anywhere on the screen by sending the proper instruction. To position the cursor, send the set-position byte value. For example, to move to line 2, position 5, send <0xc4>.

The following table shows cursor position decimal addresses on the LCD.

Line 1

128	129	130	131	132	133	134	135	136	137	138	139	140	141	142	143

Line 2

192	193	194	195	196	197	198	199	200	201	202	203	204	205	206	207

Example2:   *Sets the cursor position to the last character on line 1 of the LCD.*
        Set Cursor Position = <0x01><0x8F><LRC

6.2   Display Data Commands

The display data command writes the ASCII <data> bytes contained in this command string to LCD starting at the current cursor position of the LCD.   The CRX LCD is a two line by sixteen character display.

The CRX module may not be capable of responding to display commands while processing magnetic stripe data. Therefore, the credit card transaction processing system must allow a non-response timeout of 3 seconds. If the module fails to respond to display data within the timeout period, the
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credit card transaction processing system should reset the CRX module.

During periods of inactivity the credit card transaction processing system should refresh the display on a regular interval.

Example1: *Displays two characters of data at the current LCD cursor position.*
Display Data = <0x42> <data> <data>< LRC>

6.3 Card Reader Commands

The CRX Card Reader Commands control the format of the magnetic card data and which card tracks will be transmitted on a card swipe.

Commands	Value	Description
Enter Raw Data Mode	0xe5	Transmits Enabled Card Track Data in RAW format starting with the first bit received
Exit Raw Data Mode	0xe6	Transmits Enabled Card Track Data in ASCII format
Enable Track 1	0xe9	Enables the transmission of only Track 1 Data
Enable Track 2	0xea	Enables the transmission of only Track 2 Data
Enable Track 1 & Track 2	0xeb	Enables the tramsmission of Track 1 & Track 2 Data

6.4 Interface Commands

The Coinco CRX module supports the following interface command set to control the buzzer, LED, and system operation.

6.4.1 Buzzer Commands

The Buzzer Interface commands control the operation of the CRX buzzer.   The buzzer commands are used to indicate various states or errors during the processing of the card data and vending operations.

Commands	Value	Description
Turn on Buzzer	0x20	Turns on continuous buzzer (no beeps)
Beep Buzzer Once	0x21	Beeps buzzer 1 Time at selected tone and rate
Beep Buzzer 2 Times	0x22	Beeps buzzer 2 Times at selected tone and rate
Beep Buzzer 3 Times	0x23	Beeps buzzer 3 Times at selected tone and rate
Beep Buzzer 4 Times	0x24	Beeps buzzer 4 Times at selected tone and rate
Beep Buzzer 5 Times	0x25	Beeps buzzer 5 Times at selected tone and rate
Beep Buzzer 6 Times	0x26	Beeps buzzer 6 Times at selected tone and rate
Turn on Beeper	0x27	Beeps buzzer continuously at specified rate and tone
Select Beeper Tone 1	0x28	Changes beeper tone to tone 1 (defined by config data)
Select Beeper Tone 2	0x29	Changes beeper tone to tone 2 (defined by config data)
Select Beeper Tone 3	0x2a	Changes the beeper tone to tone 3 (defined by config data)
Select Beeper Rate Slow	0x2b	Sets the Beeper rate to slow
Select Beeper Rate Normal	0x2c	Sets the Beeper rate to normal
Select Beeper Rate Fast	0x2d	Sets the Beeper rate to fast
Turn off Buzzer	0x2f	Turns off continuous buzzer or beeper

Example1:   Beep Buzzer Once =< 0xC1>< 0x21>< LRC

6.4.2   LED Commands

The LED Interface commands control the operation of theCRX module's LED.   The LED commands are used to indicate various states or errors during the processing of the card data and vending operations.

Commands	Value	Description
Turn on LED	0x40	Turns on the LED
Blink LED Once	0x41	Blinks the LED once
Blink LED 2 Times	0x42	Blinks the LED 2 Times
Blink LED 3 Times	0x43	Blinks the LED 3 Times
Blink LED 4 Times	0x44	Blinks the LED 4 Times
Blink LED 5 Times	0x45	Blinks the LED 5 Times
Blink LED 6 Times	0x46	Blinks the LED 6 Times
Blink LED	0x47	Starts continuous blinking the LED at specified rate
Select Blink Rate Slow	0x4b	Sets the blink rate to slow
Select Blink Rate Normal	0x4c	Sets the blink rate to normal
Select Blink Rate Fast	0x4d	Sets the blink rate to fast
Turn Off LED	0x4f	Turns Off the Led (blinking or otherwise)

Example: Blink LED = <0xC1> <0x47>< LRC>

6.4.3   System Commands

The unit can receive the following System Commands.

Commands	Value	Description
Software Version	0xe0	Sends CRX software version
Reset	0xef	Resets the CRX unit
LED	0xed	Used to turn on all segments of the LCD display

Example: Reset = <0xC1> <0xef>< LRC>

Software Version

The software version will be transmitted to the transaction module on receipt of the Software Version Diagnostic Command.

CRX Software Version = <Mfg Id><S/W Identifier>"-"<S/W Revision Number>

- Mfg Id   Manufacturer of theCRX module   "CAI"
- S/W Identifier   Software ID Number (5 digits)   "67251"
- Separator   Version and Revision Separator (1 character)   "-"
- S/W Revision   S/W Identifier Revision Number (2 digits)   "03"

Reset

The Reset command performs a software reset of the CRX module.

Section 7: Controlling the CRX Module

7.0   CONTROLLING THE CRX MODULE

The following sections describe the operation of the CRX module in conjunction with a Credit Card Transaction Processing System (CCTPS). The tables below describe the actions performed by the CRX and CCTPS during typical card reader operational states.

7.1   *CRX/CCTPS Power-up (Default Settings)*

CRX	CCTPS
Power Up	Power up
Enables ASCII card data transmission	
Enables magnetic card reader tracks 1 & 2	
Blinks LED five times	
Beeps buzzer five times	
Displays Coin Acceptors and software version message on the LED	
Waits for command for the CCTPS	
Receive Software Version Command	Send Interface Command Software Version to verify CRX is Attached and Operational
Send Software Version	Receive Software Version
	Determine CCTPS Card Processing State
	If CCTPS Ready to Process Card Data go to CCTPS Awaiting Card Swipe
	If CCTPS Not Ready to Process Card Data go to CCTPS Out of Service Cash Only

7.2   *CCTPS Awaiting Card Swipe*

CRX	CCTPS
	CCPTS Ready to Process Card Data
Receives LED ON command	Sends LED ON command to CRX
Sends ASCII character ACK 0x06	
Turns on LED	
Receives LED Display Command	Send "Please Swipe Card" message to CRX LCD display using the Display Data Command
Sends ASCII character to ACK 0x06	
Displays LCD Swipe Card Message	
	Wait for CRX Card Swipe

7.3   *CCTPS Not Ready*

CRX	CCTPS
	CCPTS Ready to Process Card Data
	Sends LED OFF command to CRX
Sends ASCII character to ACK 0x06	
Turns LED OFF	
Receives LCD Display Command	Sends "Cash Only" message to CRX LCD display using the Display Data Command
Sends ASCII character to ACK 0x06	
Displays the LCD Cash Only message	
	Wait for CTTPS system to become Ready

7.4   *CRX Card Swipe*

CRX	CCTPS
Receives a valid card swipe	
Transmits Card Data to CCTPS	Receives Card Data
	Sends ASCII character to ACK 0x06 to CRX
Receives Fast Beep Rate Command	Sends Fast Beep Rate Command to CRX
Sends ASCII character to ACK 0x06	
Beeps Buzzer Once	
Receives LED Slow Rate Command	Sends LED slow rate command to CRX
Sends ASCII character to ACK 0x06	
Receives LED continous blink command	Send LED continuous blink command to CRX
Sends ASCII character to ACK 0x06	
Blinks LED Continuously	
Receives LCD Display Command	Send "Authorizing" message to CRX LCD display using the Display Data Command
Sends ASCII character to ACK 0x06	
Displays LCD Authorizing Message	
	Approves Card go to CCTPS Approves Card
	Denies Card go to CCTPS Denies Card

7.5   *CCTPS Approves Card*

CRX	CCTPS
	Approves Card
Receive Fast Beep Rate Command	Sends Fast Beep Rate Command
Sends ASCII character to ACK 0x06	
Receive Single Beep Command	Sends single beep command to CRX
Sends ASCII character ACK 0x06	
Receive Fast LED Rate Command	Sends LED blink fast rate command to CRX
Sends ASCII character to ACK 0x06	
Receive LED Continuous Blink Command	Sends LED continuous blink command to CRX
Sends ASCII character to 0x06	
Receive Make Product Selection Message	Send "Make Product Selection" message to the CRX LCD display using the Display Data Command
Displays Product Selection Message	
	Waits for the CRX Cancel Credit, Product Selection, or Transaction Timeout

7.6   *CCTPS Denies Card*

CRX	CCTPS
	Denies Card
Receive Fast Beep Rate Command	Sends Fast Beep Rate Command
Sends ASCII character to ACK 0x06	
Receive Fast LED Rate Command	Sends LED fast rate command to CRX
Sends ASCII character ACK 0x06	
Receive three beep Command	Sends three beep command to CRX
Sends ASCII character to ACK 0x06	
Receive three blinks command	Sends LED three blinks command to CRX
Sends ASCII character to 0x06	
Beeps buzzer and blinks LED three times	
Receive Invalid Card Message	Send "Invalid Card Message" message to the CRX LCD display using the Display Data Command
Display Invalid Card Message	
	Return to CCTPS Awaiting Swipe Card

7.7 *Product Selection*

CRX	CCTPS
Receive Product Selected Message	Send "Product Selected" message to the CRX LCD display using the Display Data Command
Sends ASCII character ACK 0x06	
Displays Product Selected Message	
Receive Fast Beep Rate Command	Sends Fast Beep rate command to CRX
Sends ASCII character ACK 0x06	
Receive Beep Once Command	Sends Interface Command Beep Once to CRX
Sends ASCII character ACK 0x06	
Beep one time	
	Waits for Product Selection, Cancel Credit, or Transaction Timeout

7.8 *Transaction Complete*

CRX	CCTPS
Receive Transaction Message	Send "Transaction Completed" message to the CRX LCD display using the Display Data Command
Sends ASCII character to ACK 0x06	
Displays Transaction Complete Message	
	Return to CCTPS Awaiting Swipe Card

7.9 *CRX Cancel Credit*

CRX	CCTPS
Sends Cancel Credit Command to CCTPS	
	Sends ASCII character to ACK 0x06
	If CCTPS is in the CCTPS approves card state then CCTPS should clear any remaining credit and end transaction
Receives Fast Beep Rate Command	Send Interface Command Set Beep Once to CRX
Sends ASCII character to ACK 0x06	
Receives Beep Once Command	
Beep Once	
Receives LED OFF Command	Send Interface Command LED OFF to CRX
Sends ASCII character to ACK 0x06	
Turn LED OFF	
	Go to Transaction Complete

7.10   *Selection Timeout*

CRX	CCTPS
	If CCTPS is in the CCTPS Product Selection State then CCTPS should clear any remaining credit and end transaction
Receive LED Medium Blink Rate Command	Send Interface Command LED Medium Blink Rate Command to CRX
Sends ASCII character to ACK 0x06	
Receive Beep Medium Rate Command	Send Interface Command Set Beep Medium Rate to CRX
Send ASCII character to ACK 0x06	
Receive Beep 2 Times Command	Send interface command Beep 2 Times
Send ASCII character to ACK 0x06	
Receive Blink 2 Times Command	Send Interface command Blink LED 2 Times
Send ASCII character to ACK 0x06	
Beep and Blink 2 Times	
Receive LED OFF Command	Send Interface command LED OFF
Sends ASCII character ACK 0x06	
Turn LED OFF	
	Return to CCTPS Swipe Card State

Section 8: Coinco CRX Preferred Operating States

8.0   COINCO CRX PREFERRED OPERATING STATES

The table below describes the typical operating states of a credit card transaction processing system and the preferred operation of the CRX module while in each of these states.   The table contains a listing of the different states and the associated state of the module's LED and Beeper. Each state contains a list of commands that can be implemented by the credit card transaction processing system to place the CRX in the preferred mode of operation while in the described state.

State	LED	Beeper	Commands
Please Swipe Card	LED On	Beeper Off	0xC1+0x40+LRC 0xC1+0x2F+LRC
Authorizing Transaction	LED blinks show	Beeper Off	0xC1+0x4B+LRC 0xC1+0x47+LRC 0xC1+0x2F+LRC
Card Swiped-Data Sent to Transaction Server **"NOT APPROVED"**	LED fast blinks 3 times	Beeper beeps 3 times fast rate	0xC1+0x4D+LRC 0xC1+0x43+LRC 0xC1+0x2D+LRC 0xC1+0x23+LRC
Card Swiped-Data Sent to Transaction Server **"APPROVED"**	LED fast blink 1 time	Beeper beeps 1 time fast rate	0xC1+0x4D+LRC 0xC1+0x41+LRC 0xC1+0x2D+LRC OxC1+0x20+LRC
Waiting on Product Selection	LED blinks slow	Beeper Off	0xC1+0x4B+LRC 0xC1+0x40+LRC 0xC1+0x2F+LRC
Product Selection Mode	LED blinks slow	Beeper beeps 1 time medium rate	0xC1+0x4B+LRC 0xC1+0x40+LRC 0xC1+0x2C+LRC 0xC1+0x20+LRC
Cancel Credit-Received by Credit Card Transaction Server	LED is turned off	Beeper beeps 1 time fast	0xC1+0x4F+LRC 0xC1+0x2D+LRC 0xC1+0x21+LRC
Transaction Timeout	LED is turned off	Beeper beeps 2 times at medium rate	0xC1+0x4F+LRC 0xEC+0x2C+LRC 0xEC+0x22+LRC
Out of service	LED is off	No beeper	0xC1+0x4F+LRC 0xEC+0x2f+LRC

9.0 ADDITIONAL REFERENCES

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